Assessment of Potential Lake Sturgeon Habitat Availability in Northern Lake Michigan Tributaries: Applications to the Restoration Process

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Forestry & Natural Resources
PURDUE UNIVERSITY

Natural Resources Damage Assessment & Restoration Program
Restoration Program

Great Lakes Fishery Trust

Project background

- Historic/present status
- Factors
  - Overexploitation
  - Impediments to migration
  - Physical habitat alteration
  - Water-quality degradation
- Increased public awareness, value, appreciation
  - Improved water quality
  - Highly-restricted harvest
- Some stock recovery

Project background

- Remaining impediments to recovery
  - Physical habitat alteration
    - Alteration of flow regimes (dams)
    - Land-use practices
    - Erosion/sedimentation
  - Impediments to migration
    - Dams
      - Block access to historic spawning sites
      - Decrease habitat availability
- Relatively permanent, physical changes

Project background

- Remediation
  - Rehabilitation of habitats
  - Provide access (fish passage)
  - Removal of barriers
- Current problems
  - Costly processes
  - Limited information exists
    - Where potentially effective?
    - Potential benefit?
    - Which systems?

Project background

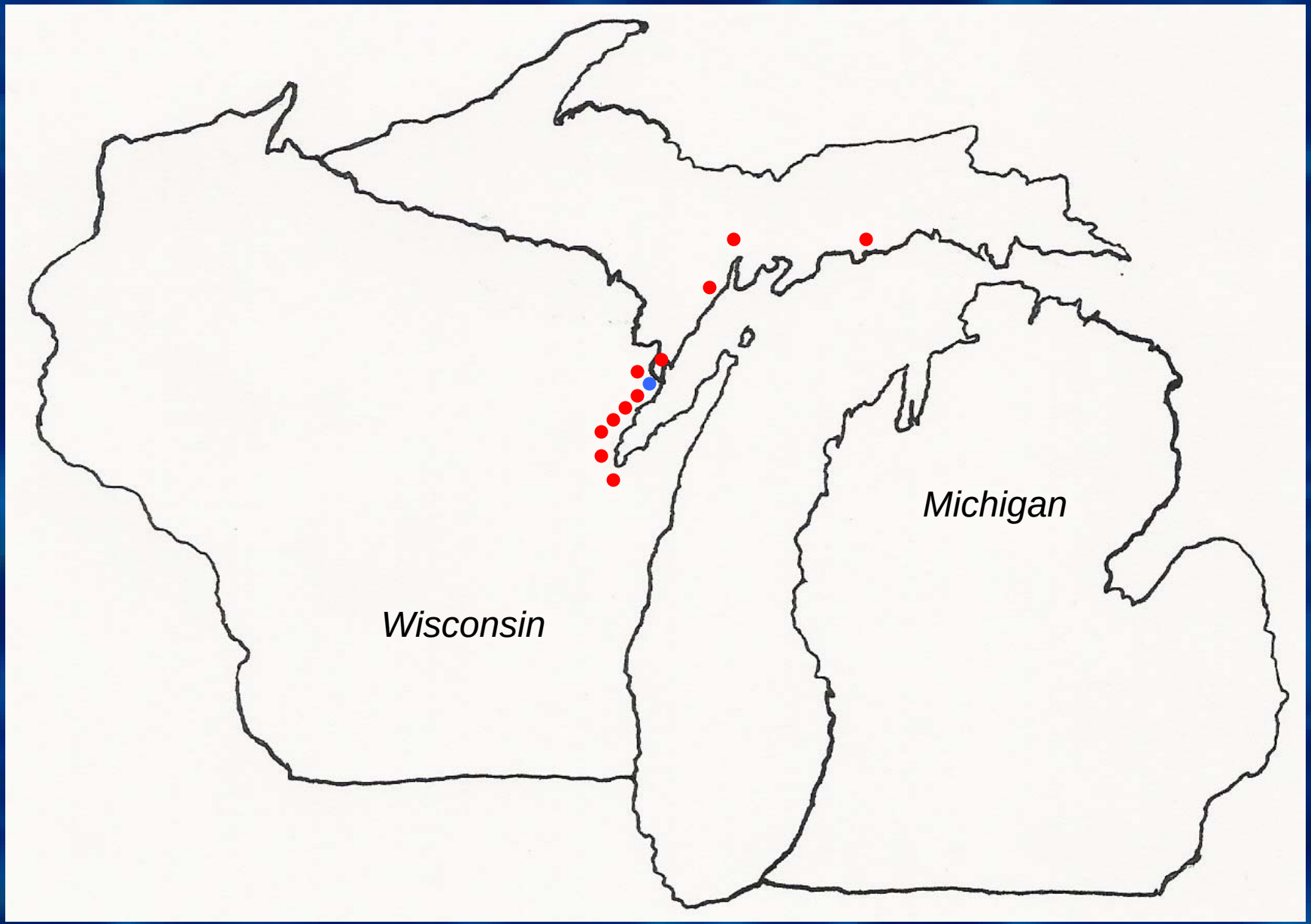
- Needs:
  - Information on existing habitats
    - Quantification of habitat types
    - Spatial configuration
    - Current accessibility
  - Implementation of restoration strategies
  - Prioritization of systems

Project objectives

- Assess/quantify riverine habitats
  - Egg/larval
  - Juvenile
  - Spawning/staging adult
- Development of digital maps
  - Geo-referenced
  - Spatial relationships
- Develop a habitat-based decision tool
  - Determination of appropriate restoration strategies
  - Prioritization of systems

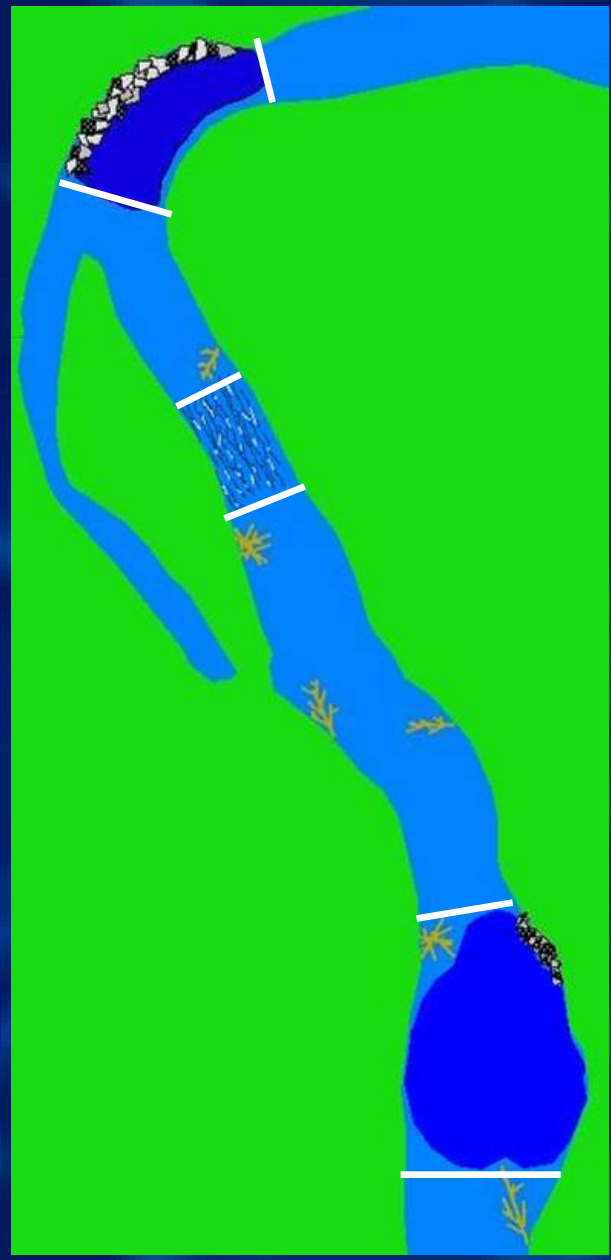
Methodology

- Northern Lake Michigan systems:
  - Manistique
  - Fox
  - Ford
  - Menominee
  - Peshtigo
  - Oconto
  - Suamico
  - L. Suamico
  - Duck Creek
  - Fox
- Sampled to historic, natural migration barriers


Michigan
Wisconsin

Methodology

- Stratified, random sampling
  - Run, riffle, pool habitat types
  - Randomly spaced transects
- Point-samples
  - Left, middle, right channel
  - Substrate composition
  - Water depth
  - Flow rate (bottom)
  - Georeferenced (GPS)



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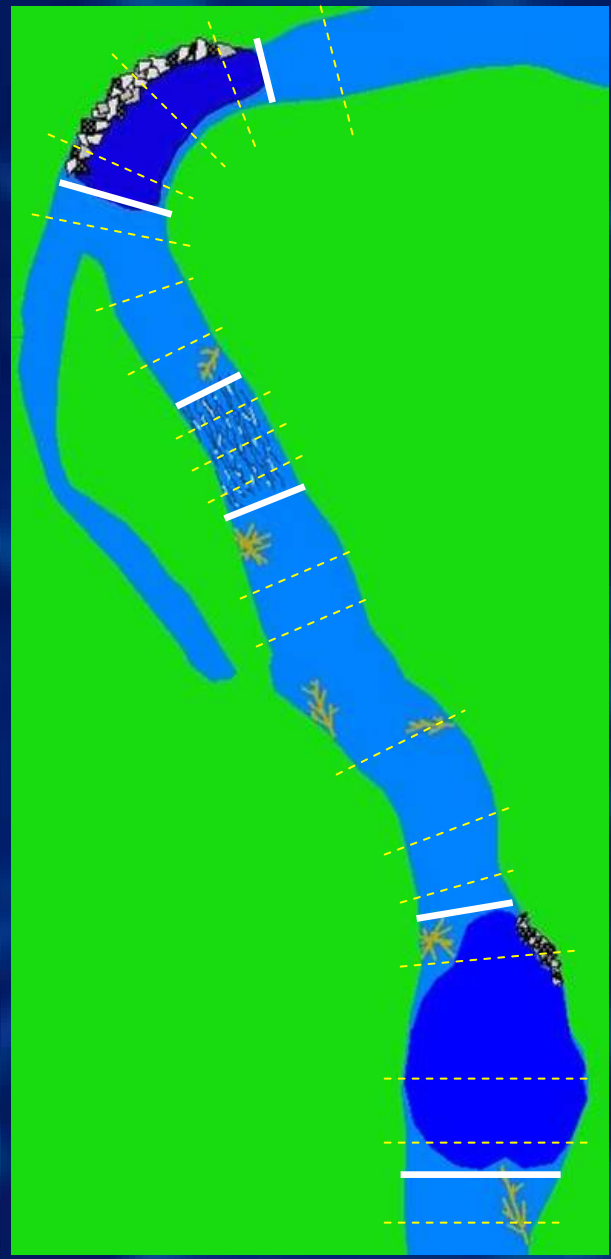

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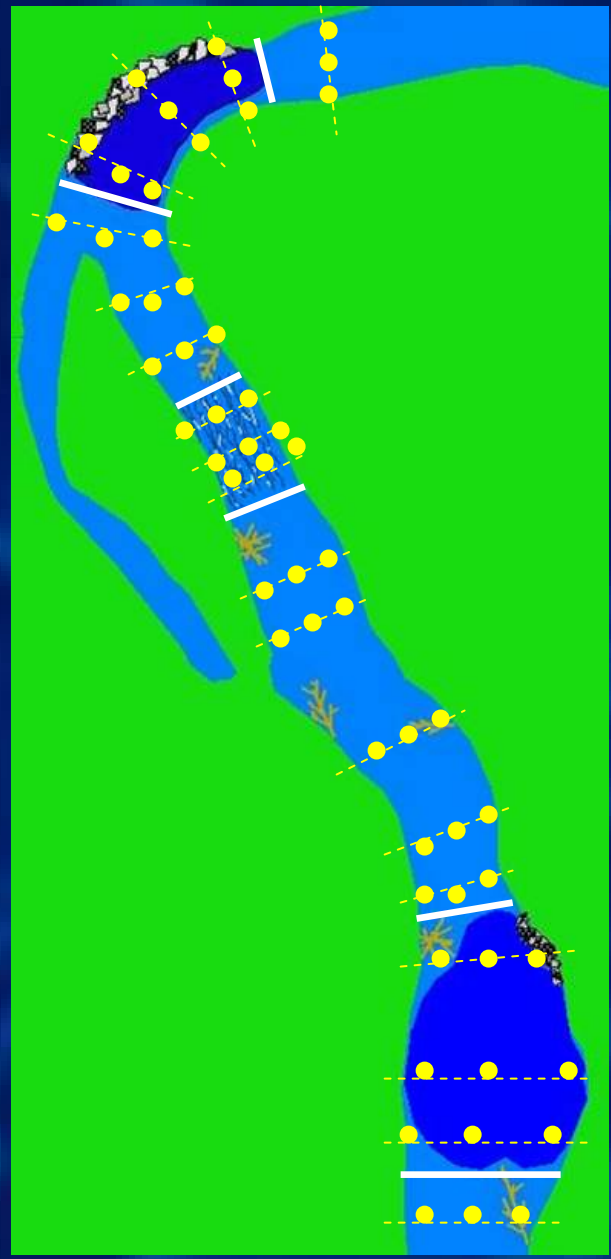


Methodology

- Additional data considerations
  - Estimation of spring spawning/staging habitat variables
    - Hydrologic discharge/flow relationships
    - Generation of additional seasonal data
  - Seasonal temperature and flow models

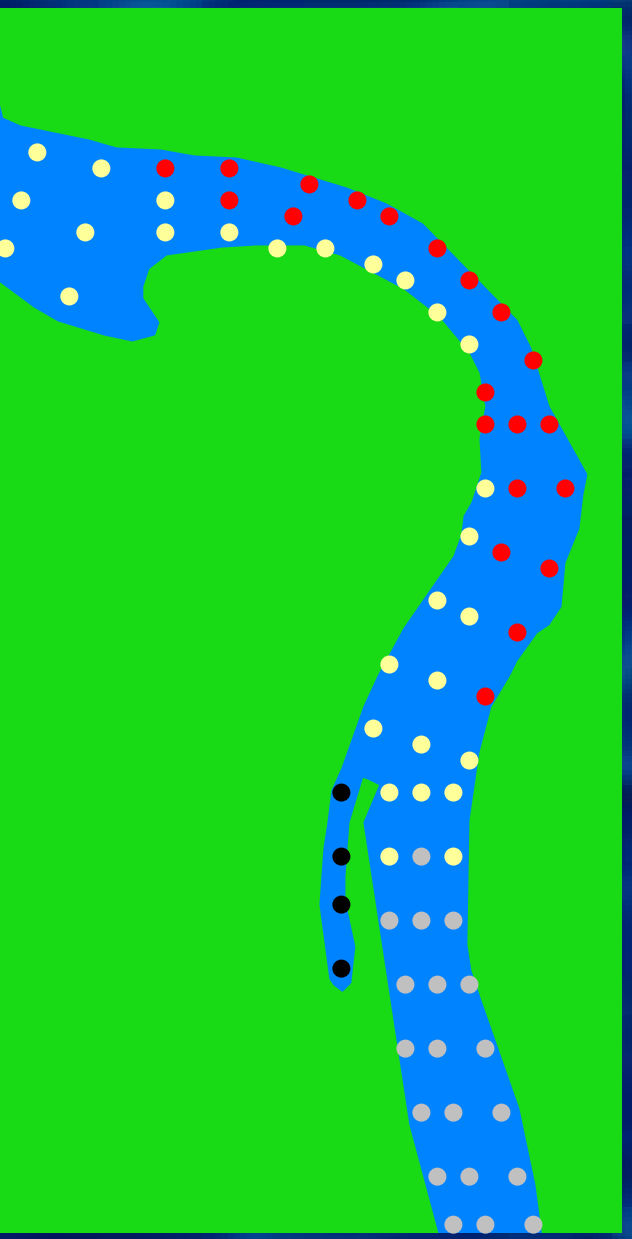
Data analyses

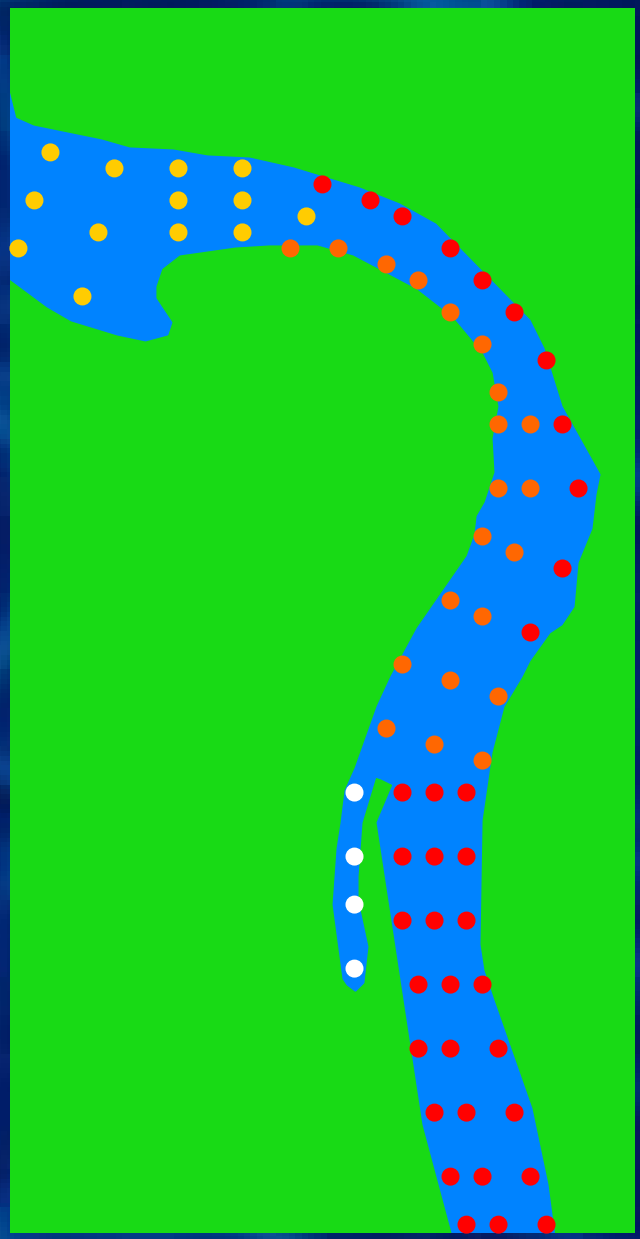
- Spatial analyses – ArcView/ArcGIS©
  - Import coordinates and point-sample data
  - Spatial analyst extension
  - Interpolate variables
  - Create of grids and reclassify data
  - Spatial analyst - map calculator
    - Determine habitat availability
      - Known habitat-use characteristics
      - Each life-history stage

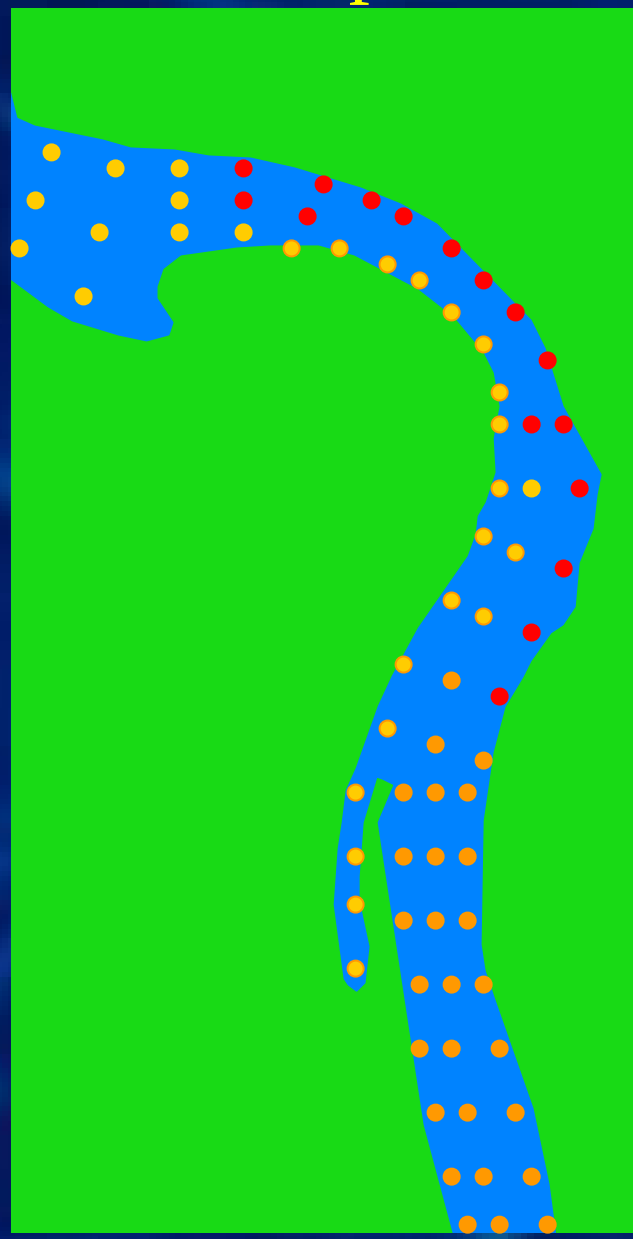
Substrate

Flow

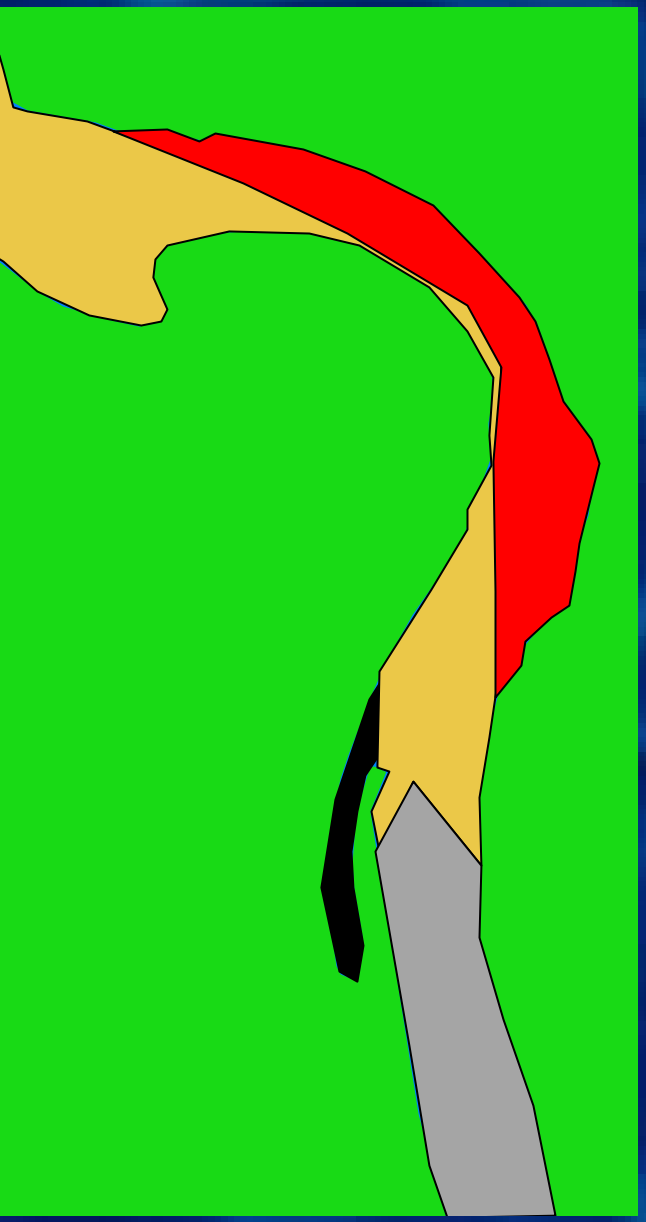
Depth



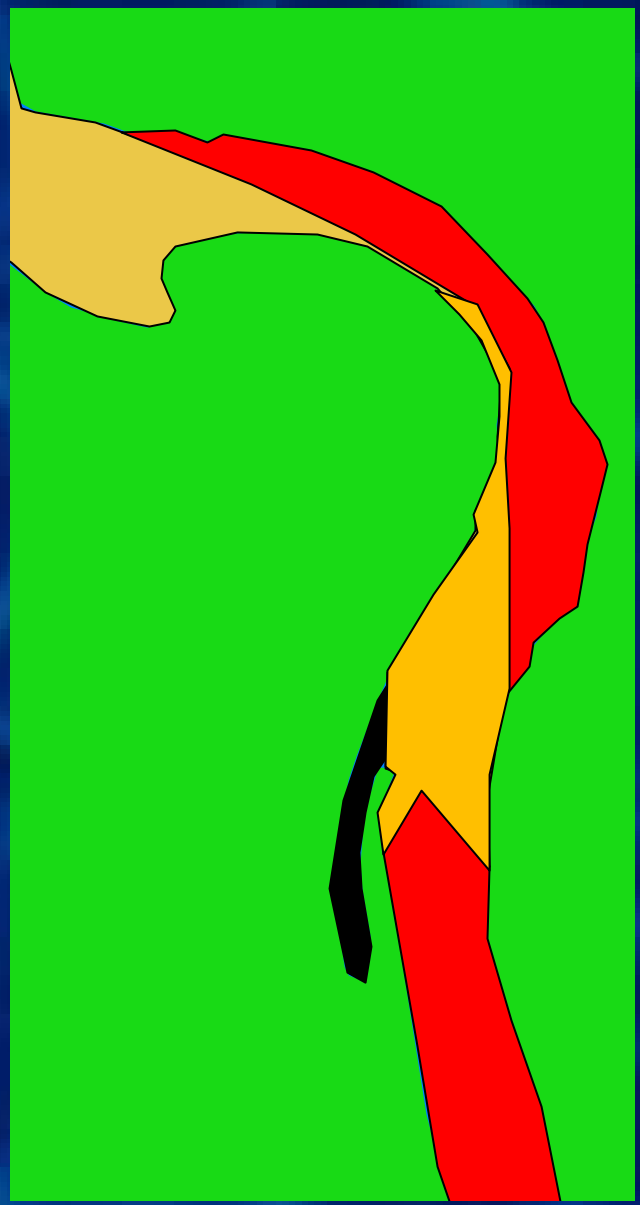




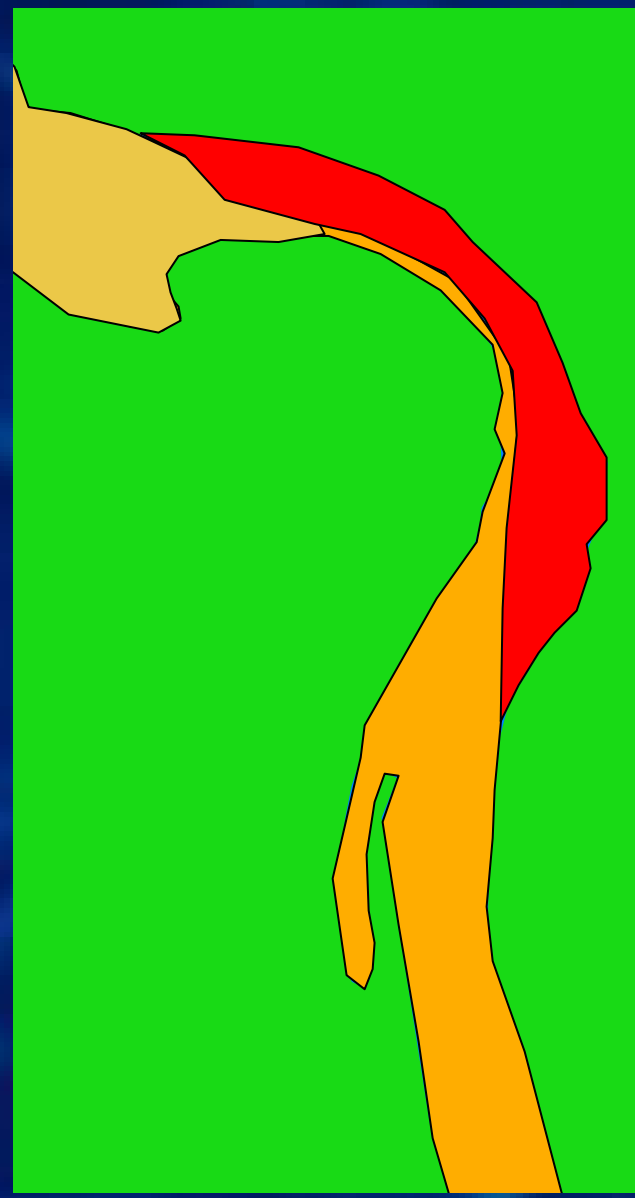
Substrate

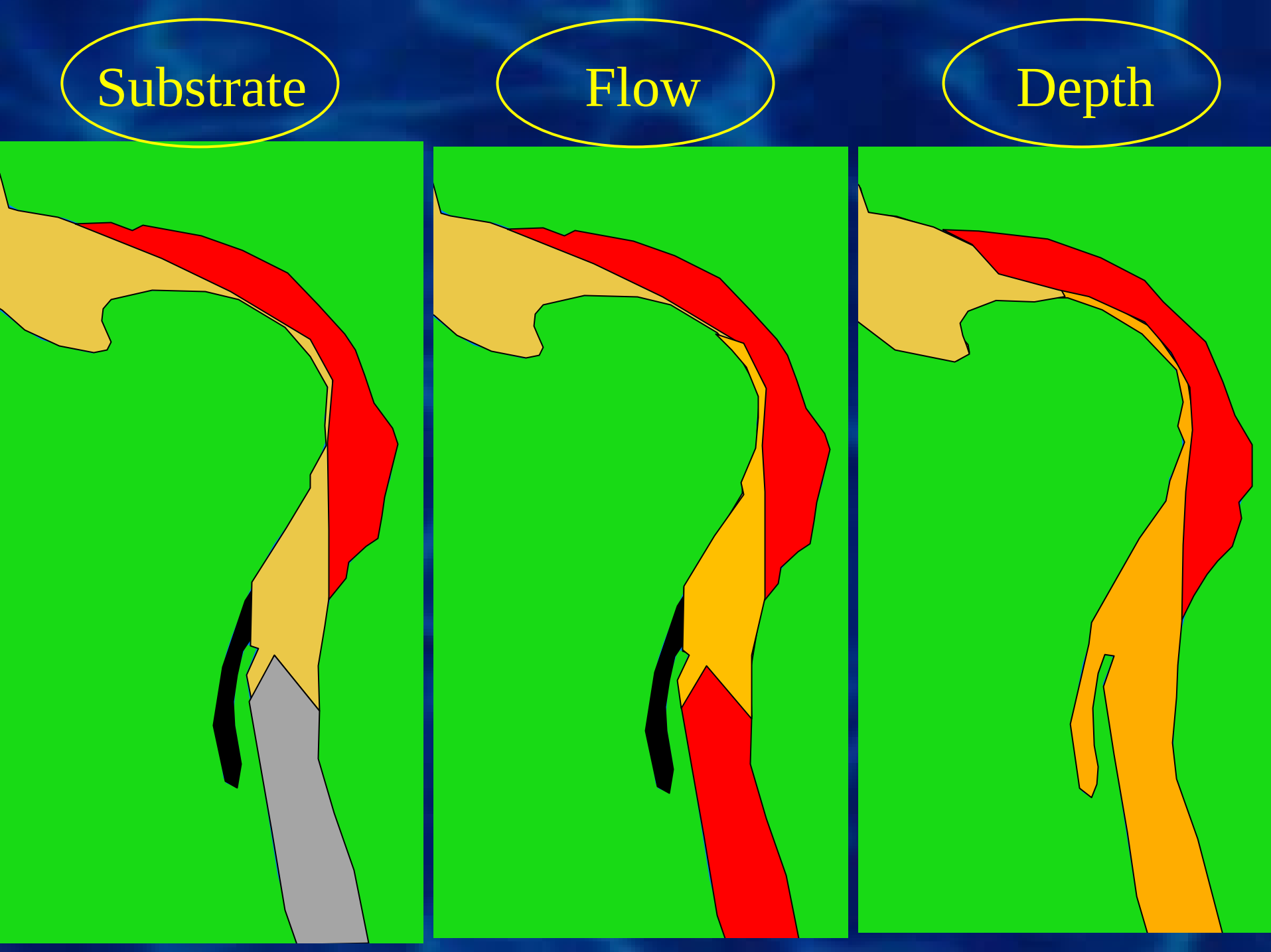


Flow

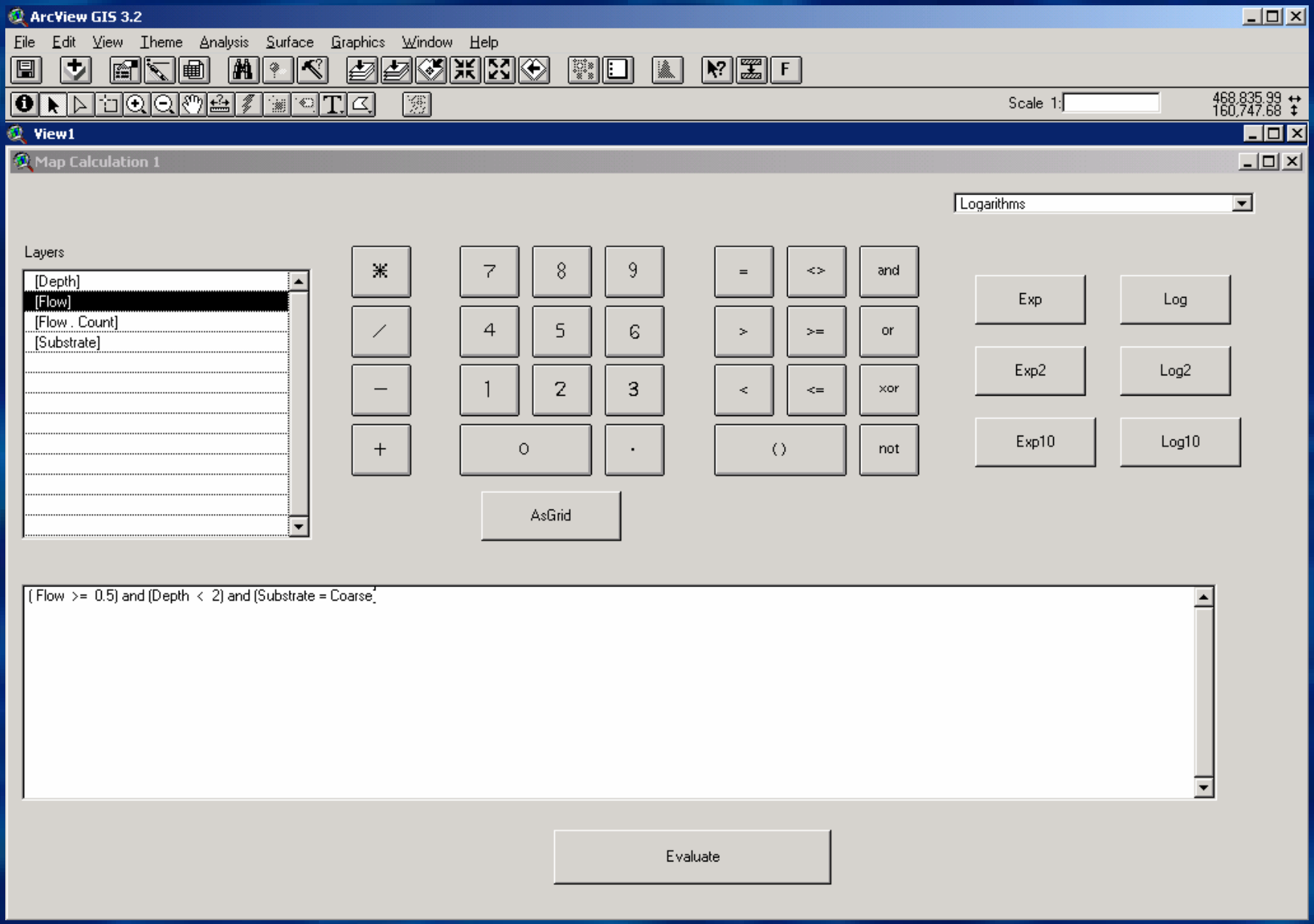


Depth



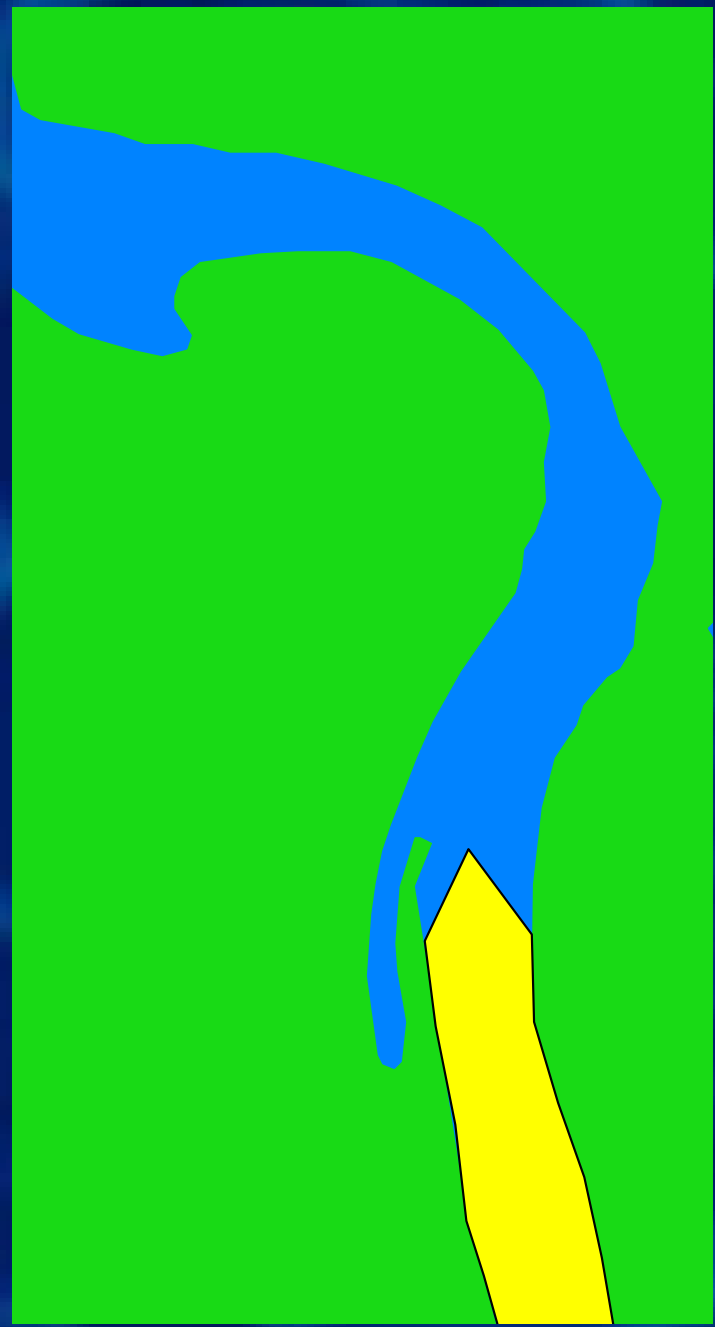

Substrate
Flow
Depth

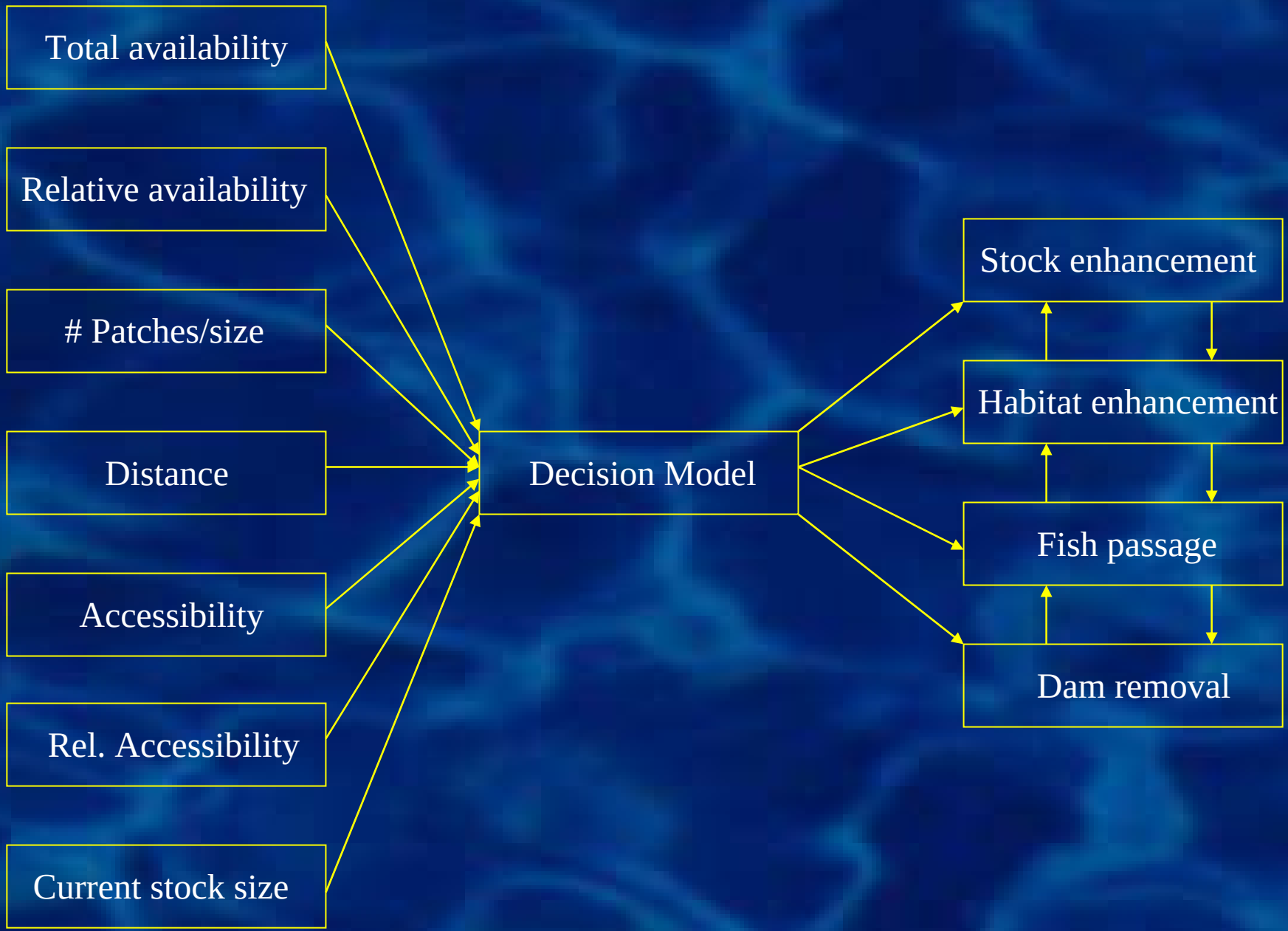
Map Calculator



Map Calculator

- Provides estimated feature coverage based on user-specified criteria
- Alter criteria for various life stages and repeat analyses
- Remains geo-referenced




Total availability
Relative availability
Patches/size
Distance
Accessibility
Rel. Accessibility
Current stock size
Decision Model
Stock enhancement
Habitat enhancement
Fish passage
Dam removal

Management benefits

- Realization of enhancement/rehabilitation
- Incorporates all lifestages
- Allows for prioritization of systems
  - Cost-effectiveness
  - Approximation of effort/cost
- Provides framework
  - Behavioral advances
  - Biological advances

Management benefits

- Development of decision tool
  - Applicable to other systems